


**THE HEALTH  
EFFECTS OF 5G  
RADIOFREQUENCY  
RADIATION**

## Eric Swanson



- professor of physics at the University of Pittsburgh
- 100+ publications in biophysics, nuclear, and condensed matter physics
- Fellow of the American Physical Society 
- founder APS Topical Group on Hadronic Physics

I will be presenting the consensus view on RFR

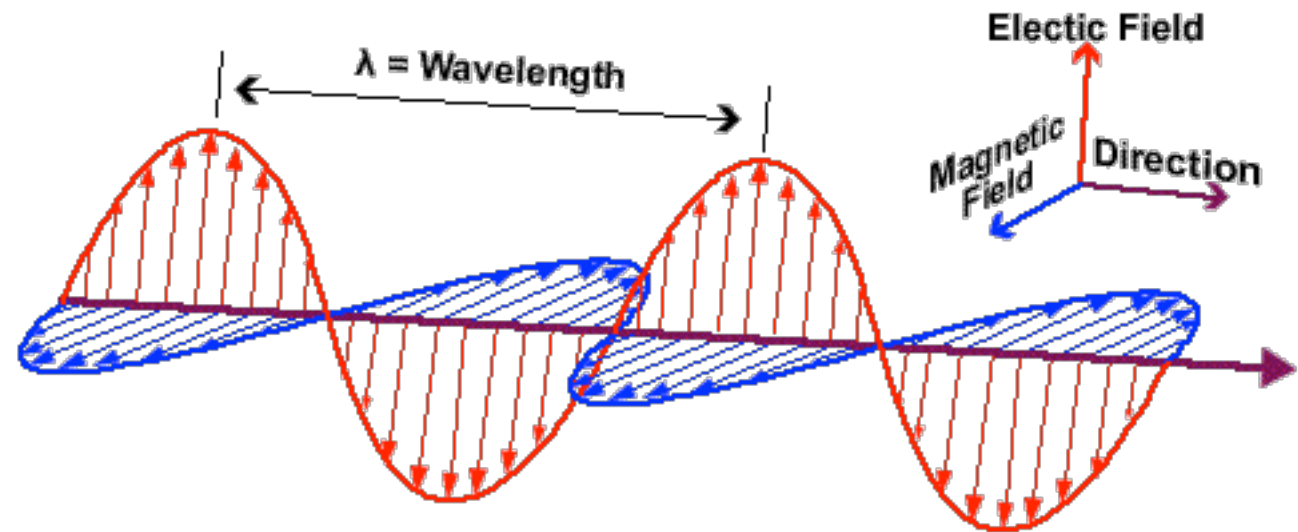
5G (4G, etc) cell phone radiation is electromagnetic and forms part of the electromagnetic spectrum.



**James Clerk Maxwell**

(1831 – 1879)

Scottish physicist.

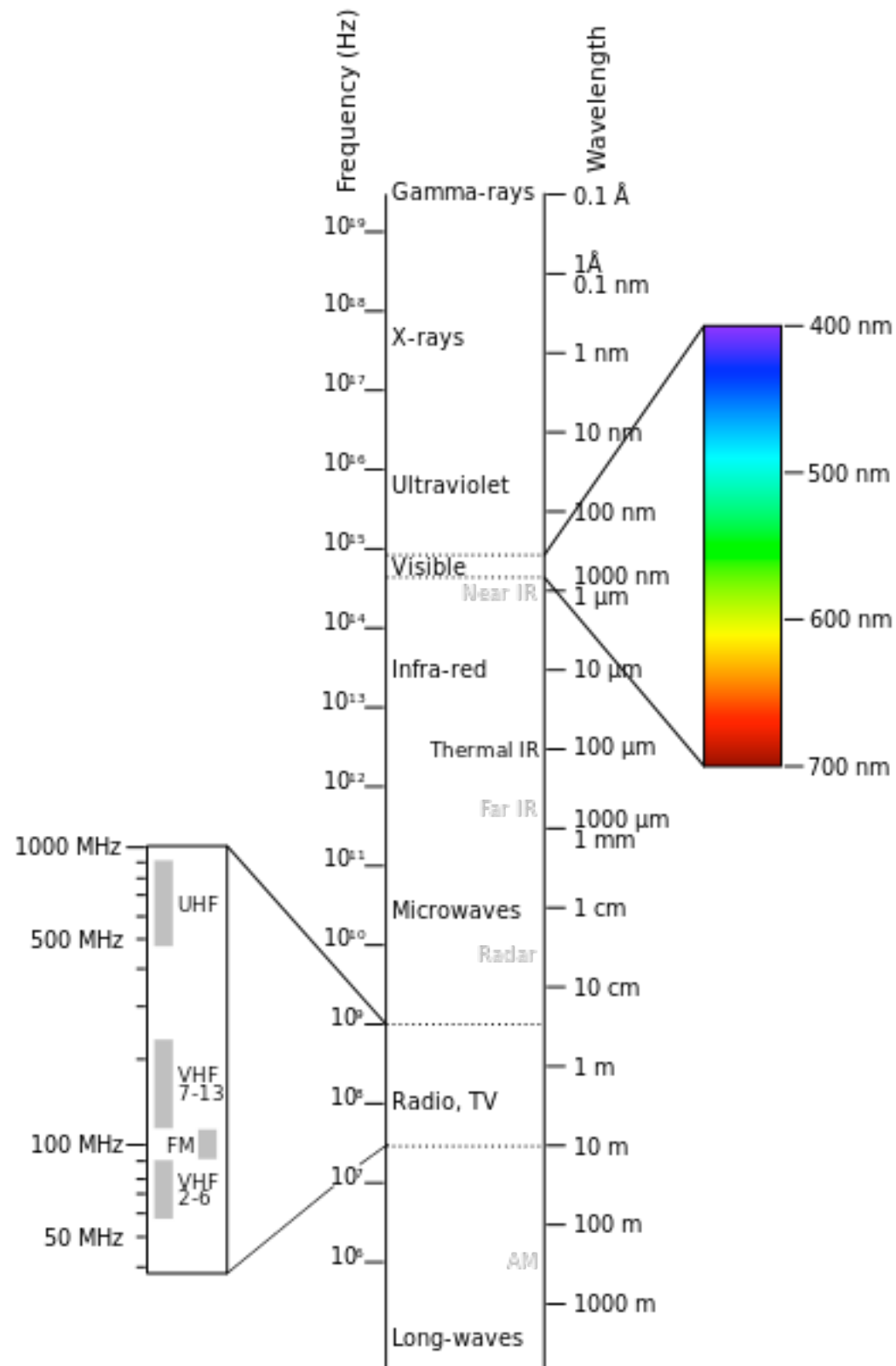


Electromagnetic radiation is the *best understood phenomenon in the universe*.

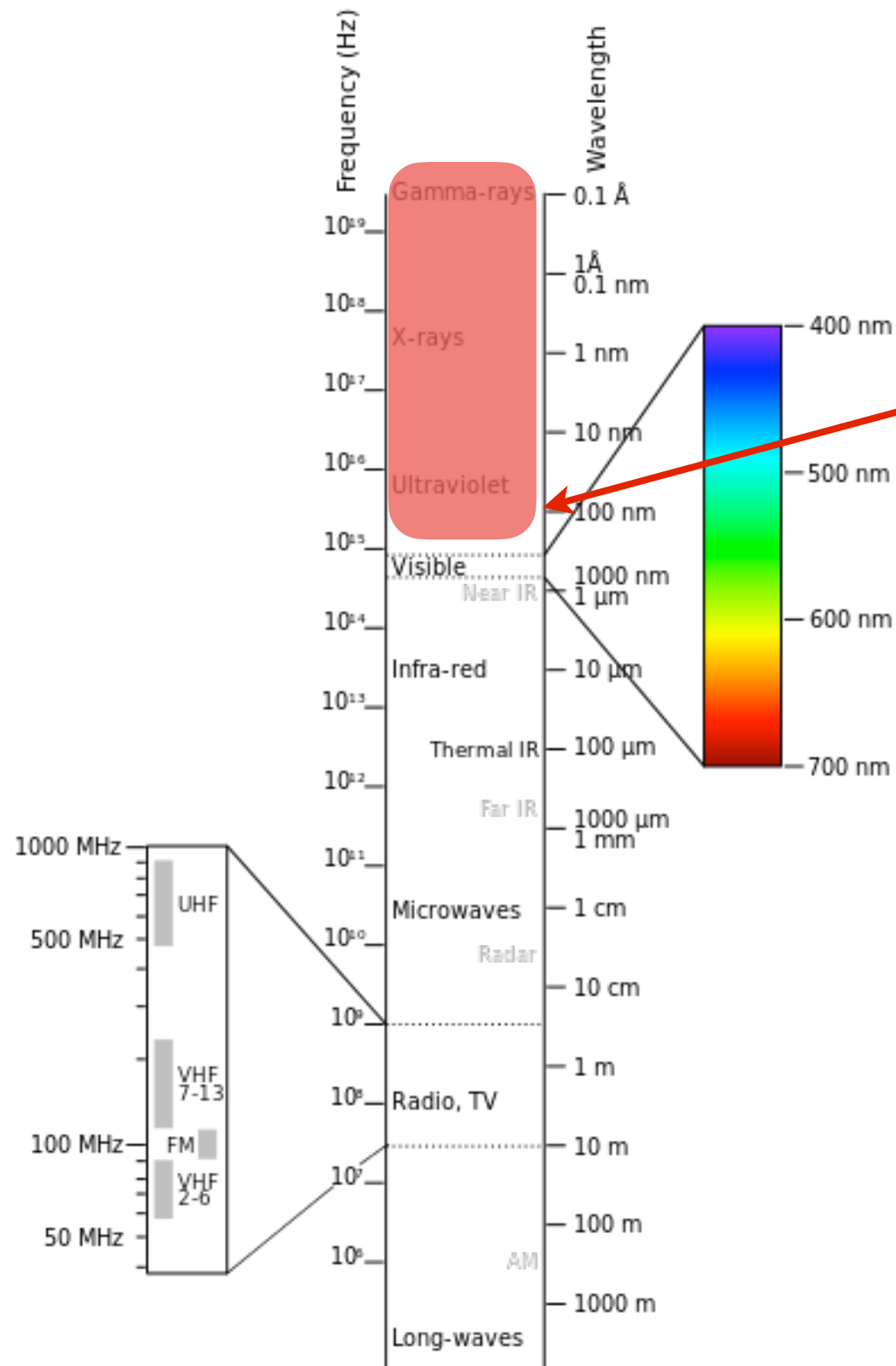
It is **not** nuclear radiation!

It is completely described by three numbers (intensity, frequency, and polarization)

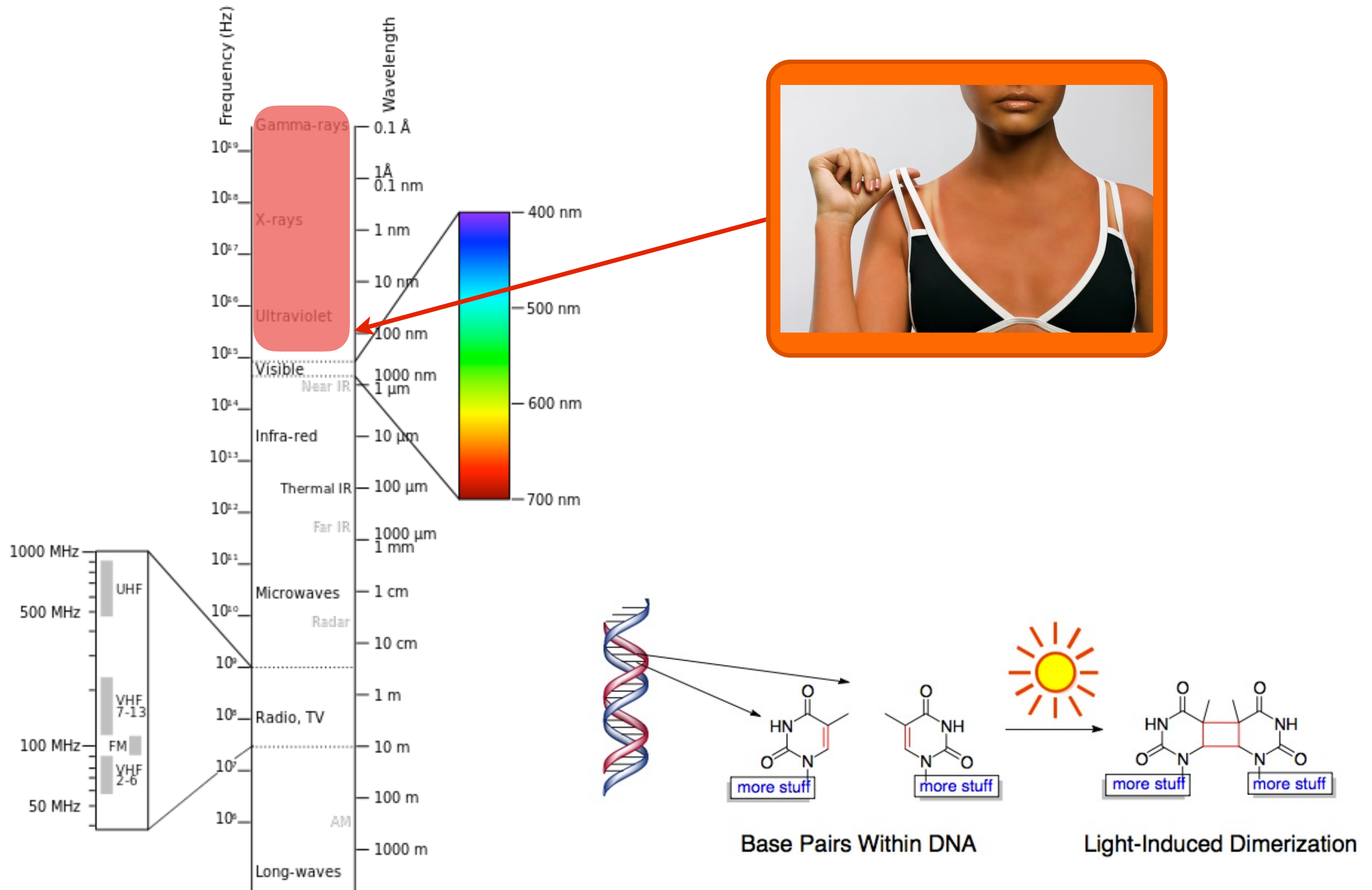
# The electromagnetic spectrum



*Some* electromagnetic radiation is dangerous.

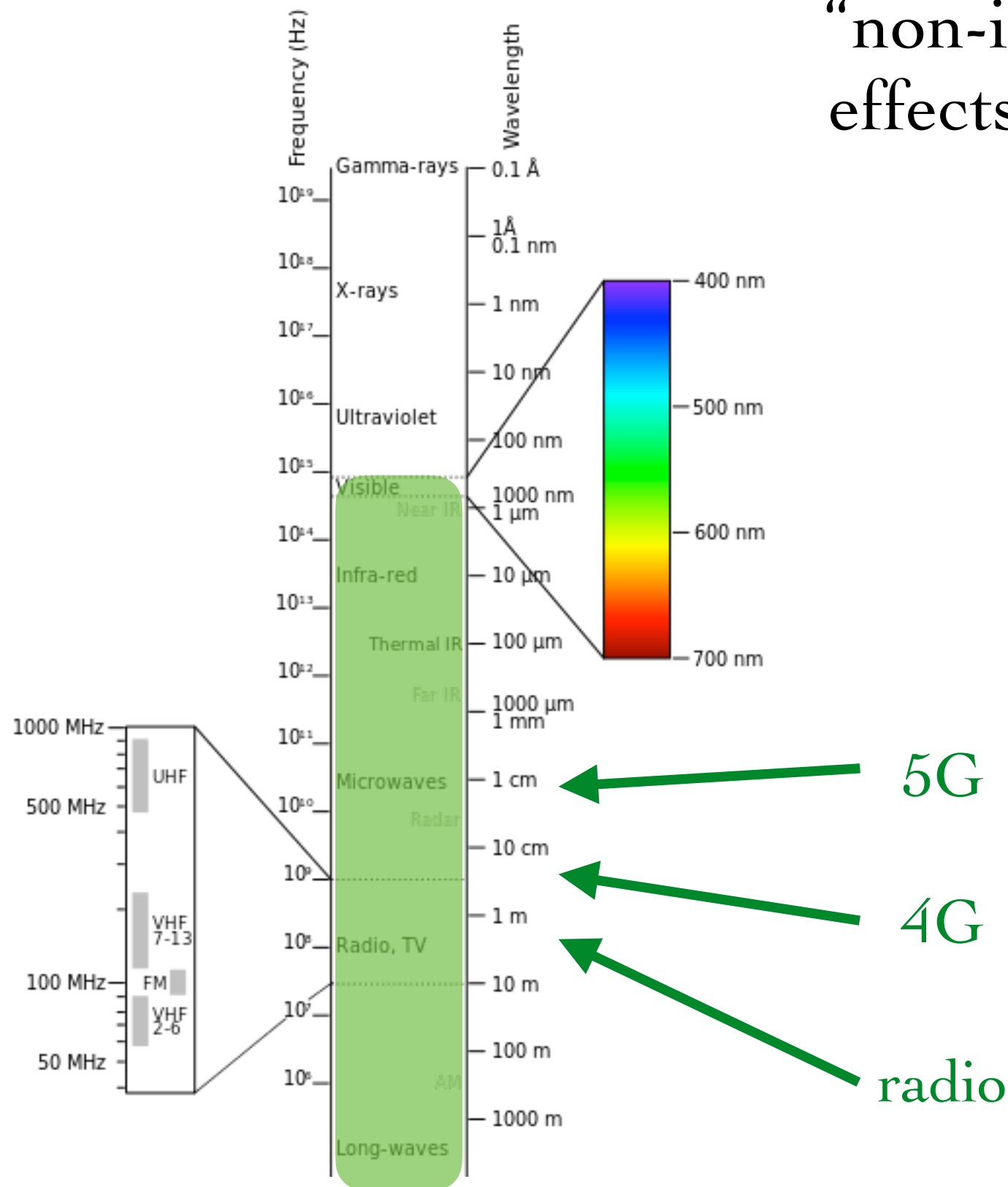


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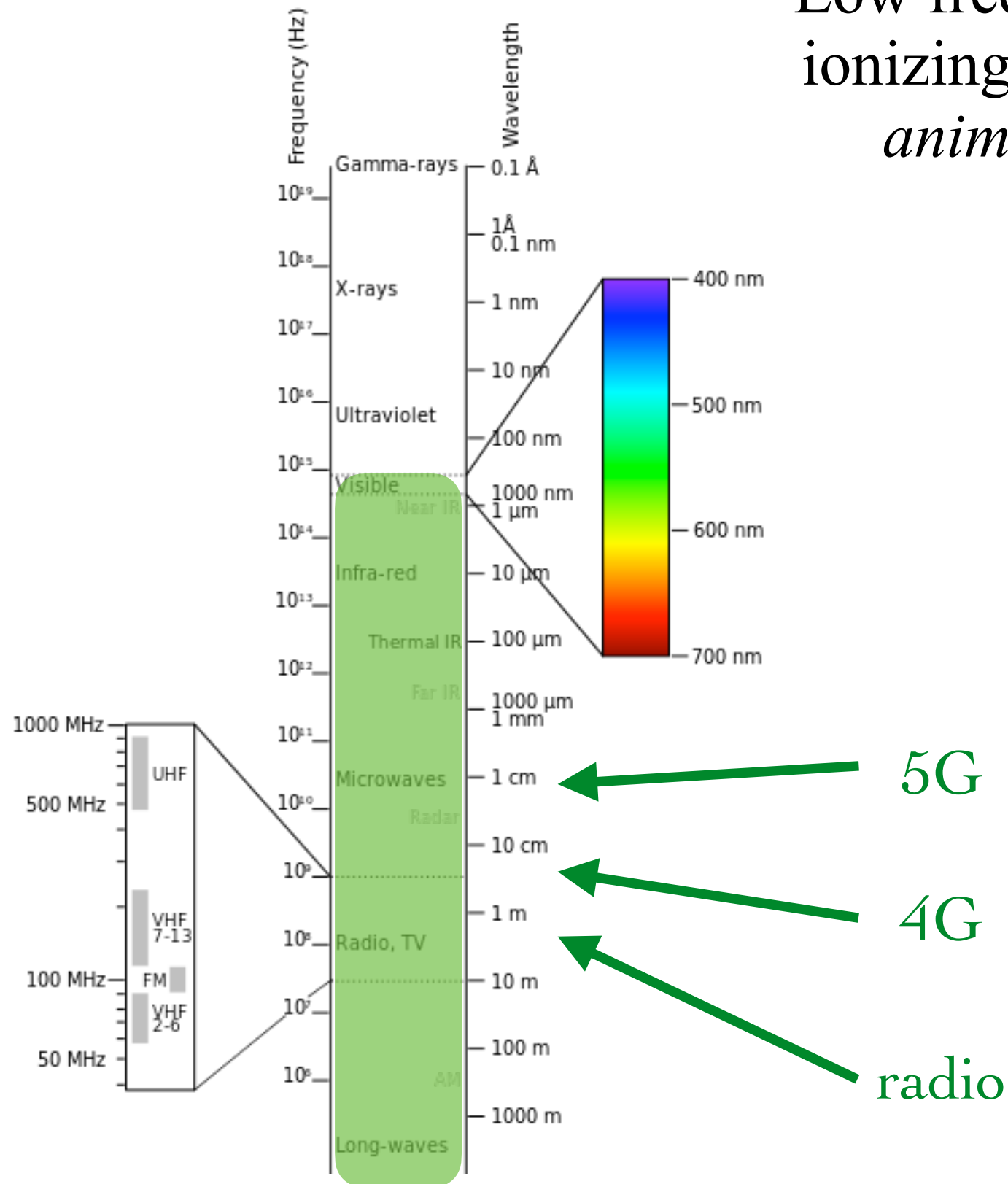


Low frequency radiation is called “non-ionizing” and had no verified effects on animal tissue other than heating.



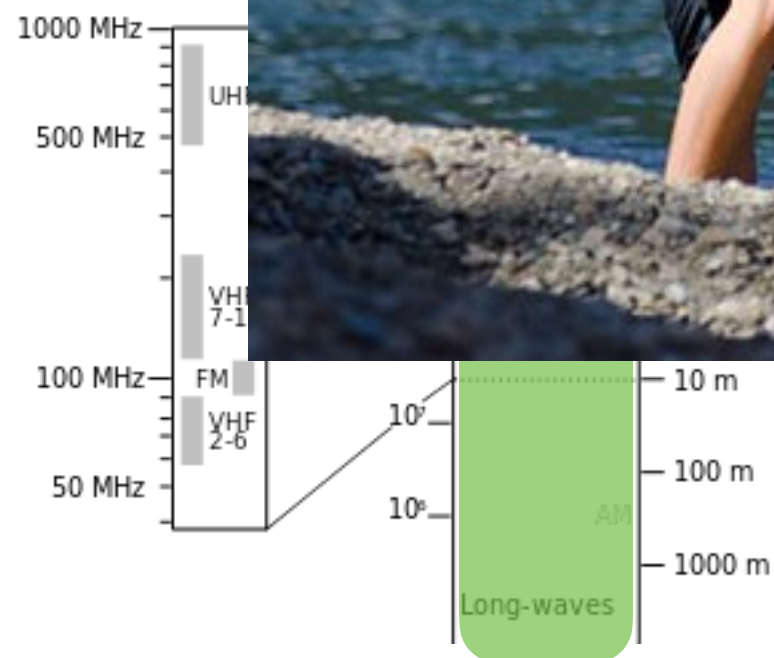
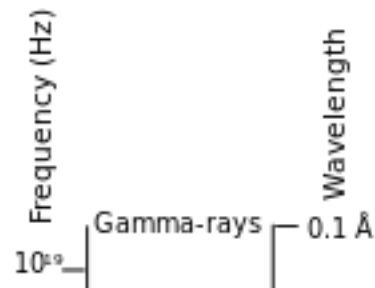


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A physics principle called the **photoelectric effect** tells us that *the intensity of the radiation and the length of time exposed to it do not matter (for cancer).*

Low frequency radiation is called “non-ionizing” and had *no verified effects on animal tissue other than heating.*



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The heating caused by nonionizing radiation is the same as “regular” heat, is *very* mild, and is strictly regulated by the FCC.





The FCC does not conduct experiments — it sets regulatory limits based on the evaluation of relevant literature made by many national and international agencies.

1000's of studies have been examined

FDA, EPA, OSHA, National Institute for Occupational Safety and Health, National Council on Radiation Protection, IEEE, etc



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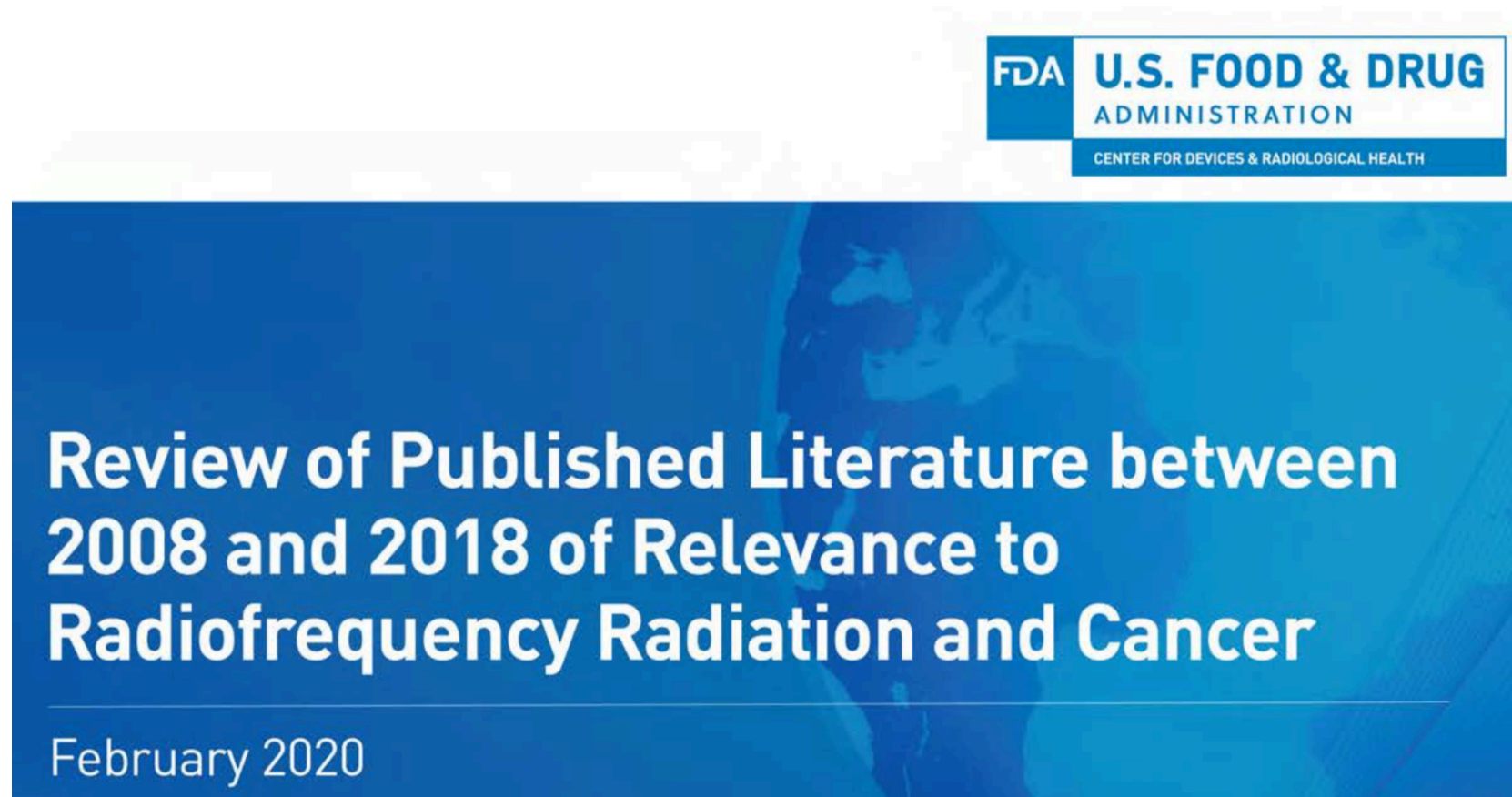
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Exposure limits are set at about 1/50 of what has detectable effects in animal experiments.



These limits are regularly reviewed and updated.



“[For 2008-2018] there have been approximately 125 articles that are most relevant for the study of any effects of RFR on animals. However, none have adequately demonstrated that localized exposure of RFR at levels that would be encountered by cell phone users can lead to adverse effects.”

“In the last decade, there have been approximately 70 relevant epidemiological studies that have been published as peer-reviewed scientific evidence. “

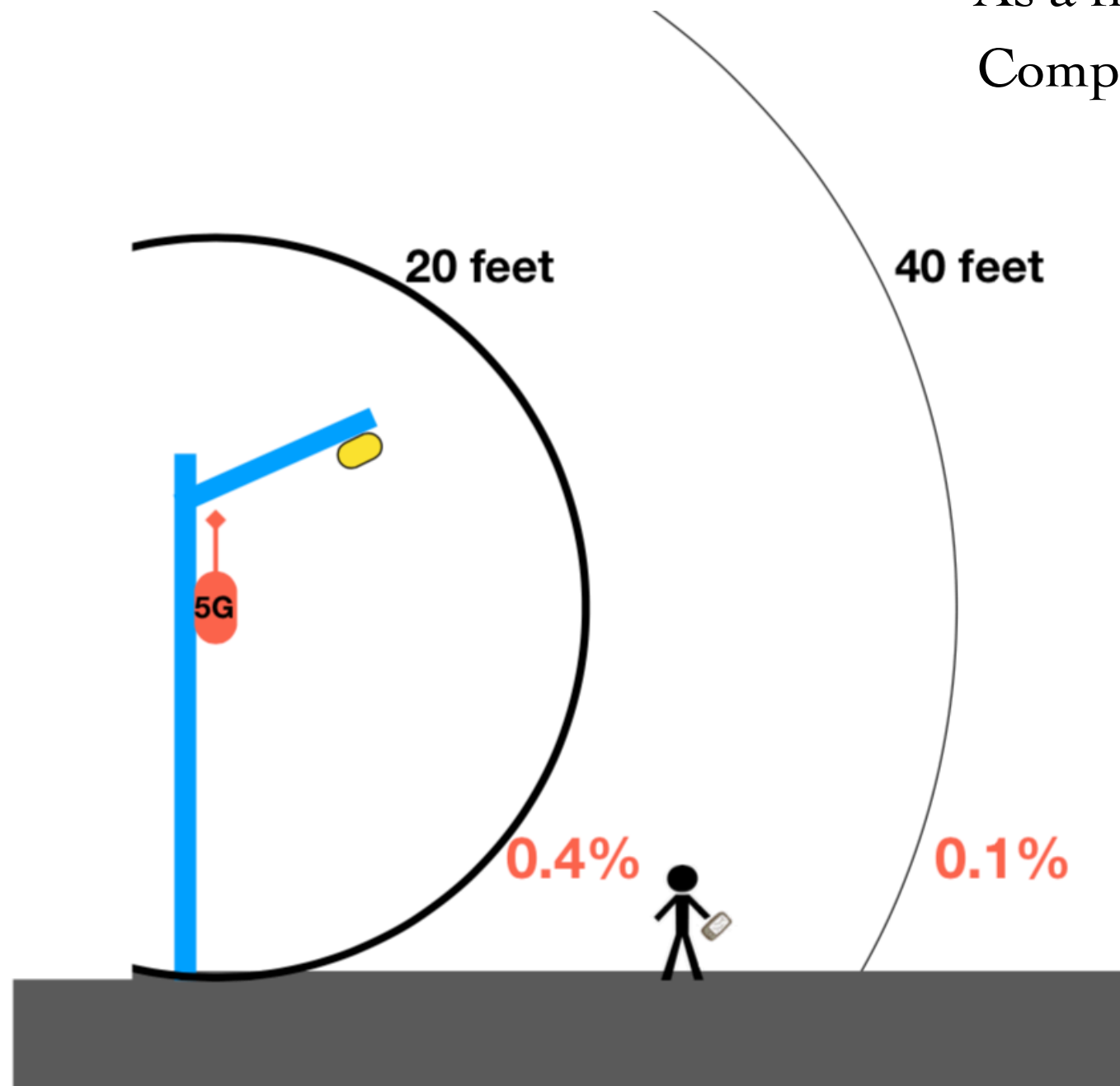
“...available epidemiological and cancer incidence data continues to support the Agency’s determination that there are no quantifiable adverse health effects in humans caused by exposures at or under the current cell phone exposure limits. “

# For comparison

Exposure due to a 5G small cell

As a fraction of MPE

Computed using the  $1/r^2$  law



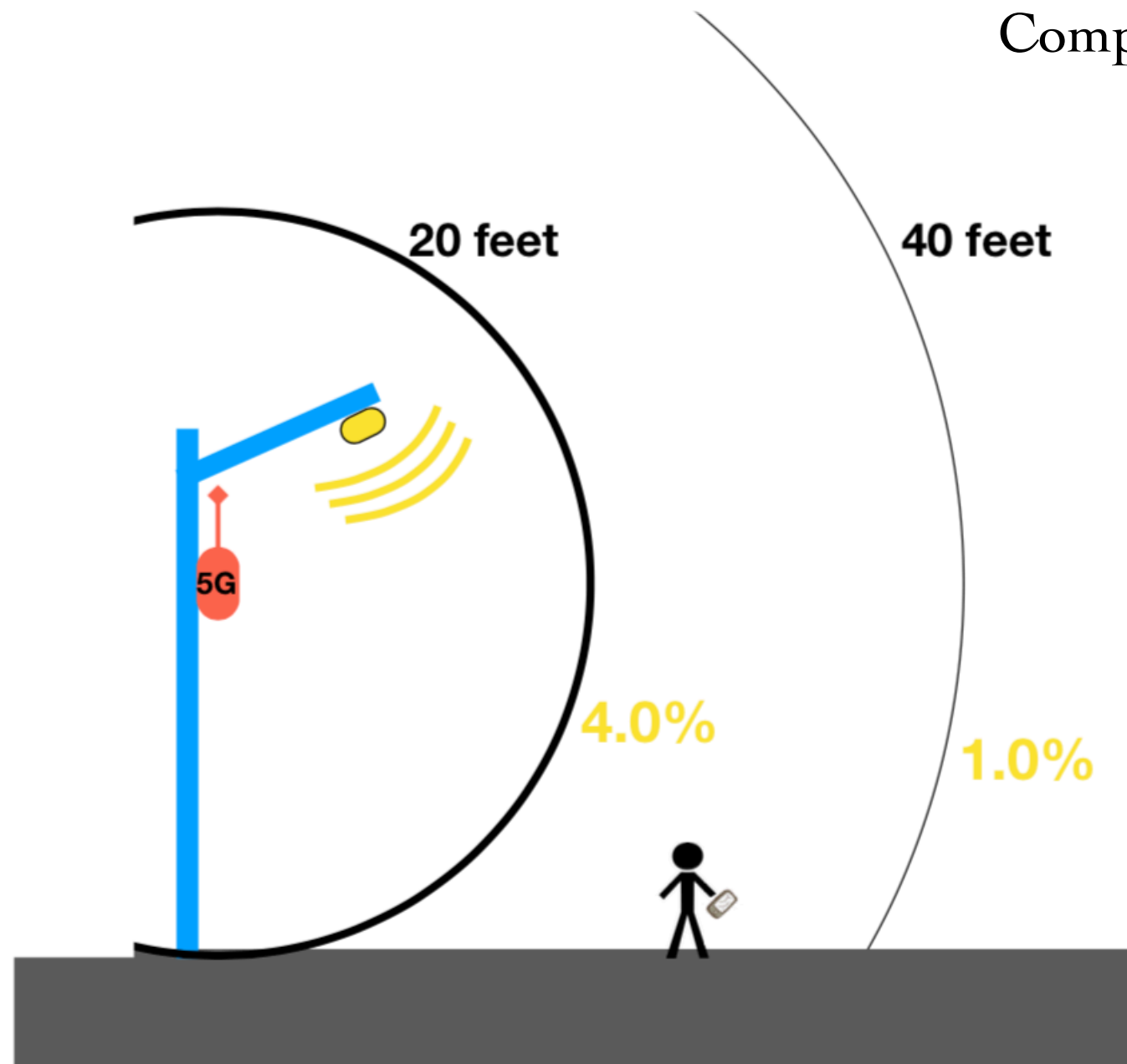


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Exposure due to a 5G small cell

As a fraction of MPE

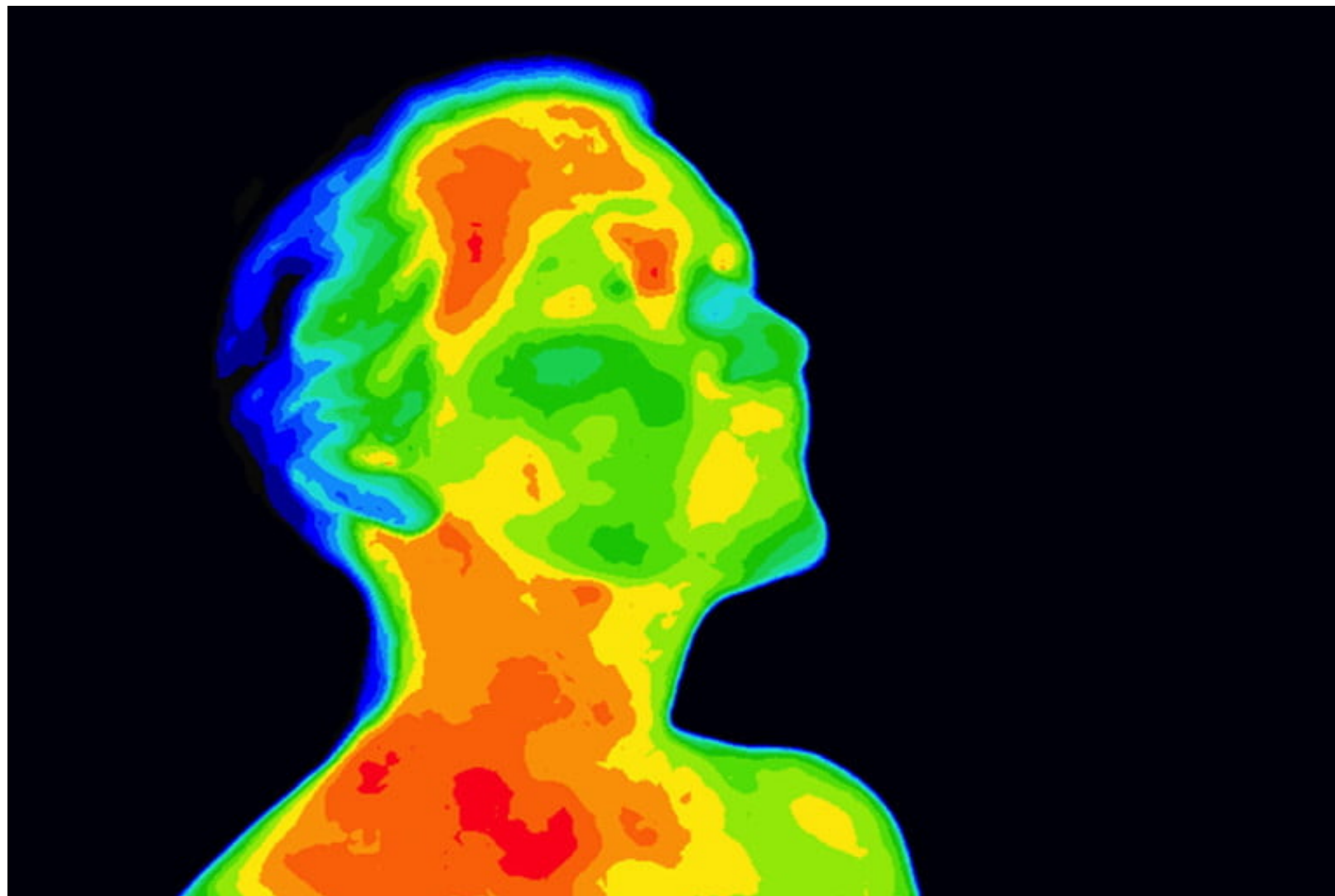
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# For comparison

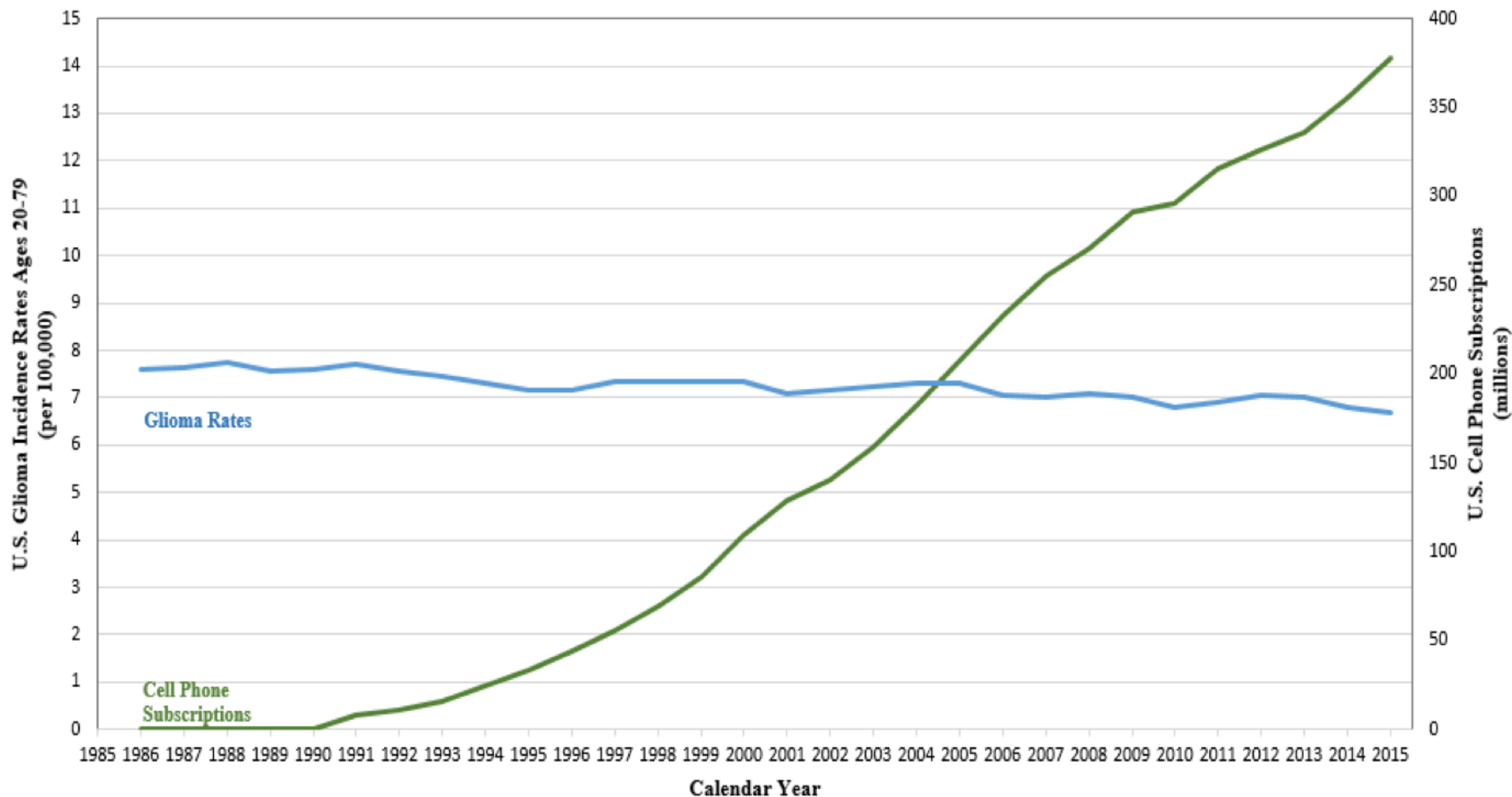
The brain is a 15W electromagnetic thermal radiation transmitter

$$\text{SAR} \sim 15 \text{ W/kg}$$



# The bottom line:

Trends in age-standardized incidence rates of glioma in the United States, 1985-2015 (SEER Registry) vs. cell phone subscriptions



Thank you